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ABSTRACT

This study examines the effectiveness of biographical inventory data as a predictor of college performance particularly among the disadvantaged where current college entrance procedures provide less than a satisfactory alternative. The sample consisted of 1,640 students of which 982 were in special admissions programs, 554 were regular admission students and 104 were students in a black university. Students were administered form ALPHA II of the biographical inventory. Results indicated the biographical data were generally equally effective or slightly superior to the high school performance measures in predicting college G.P.A. Biographical scoring keys did not provide any differentiation between blacks and whites. It was observed that the degree of relationship between biographical data and race was largely a function of the criterion-race relationships. An extensive bibliography is included. (MJM)

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Introduction

College admission procedures have historically served two primary purposes: insuring that students have the preparation necessary for college work and adjusting enrollment in response to differing conditions of supply and demand (Davis, 1968). These functions seem innocuous on the surface, yet, if analyzed more thoroughly, a number of complex and controversial issues are raised. For example, these same purposes can be viewed as being a means of rejecting individuals by denying their competence and of barring some from the use of public facilities. This in turn may tend to maintain the status quo and perpetuate the socio-economic standing of various disadvantaged groups. These college admission issues were part of the social landscape, as were college protests, riots, and other social disruptions, when this study on the use of biographical information as a predictor of college success was initiated.

Since the widely used college entrance exams typically result in marked mean differences between certain racial and socio-economic groups, these groups are at a real disadvantage when it comes to being accepted for college education. In response to urgent demands by minority groups for social change, the colleges and universities initiated a variety of special programs for the disadvantaged which to some extent shifted the burden from selection to training (Padilla, 1972). These programs tried to provide for the development of necessary skills and characteristics so that a wider variety of students would have the opportunity to obtain a college education. The developed programs differ greatly and it is still questionable whether they are indicative of a significant departure from the usual academic program or merely serve as a temporary relief valve to meet social pressures. The question still remains, however, as to whether disadvantaged students when admitted to college via special programs, would experience excessively high rates of failure which would lead to even greater pressures for social change (Stanley, 1969; Humphreys, 1969).

The resolution of such questions as who should attend college should ultimately be based in part upon the manpower needs of society for, if society has an important responsibility to correct past mistakes, it also must be concerned with allocating limited resources, including educational resources, in an economical manner to those who will in turn provide the most benefit to society. This opens to question the purposes of a college education and how success is to be defined (the criterion problem and its attendent complexities). If one of the purposes of a college education is preparation for adult careers, then it would seem fairly obvious that both the selection procedures for education and the educational process itself should be

linked to the ultimate goal of occupational performance. Yet, college entrance exams have practically never been studied in that context and, in a number of studies, college achievement has shown a limited or non-existent relationship to career performance (Hoyt, 1966; 1968).

These kinds of questions can be restated to facilitate analysis. For example, the question of who should attend college can be divided into the slightly more manageable questions of: "In what way, to what extent and, where should various individuals be educated?" This makes more obvious the need for a wide variety of educational training programs as well as admittance procedures in serving the complex needs of society.

One possible contribution to the resolutions of these complex problems would be the development of more efficient measuring procedures which: (1) would help to guide admission officers in selecting those individuals who had a greater probability of succeeding in college, (2) would not raise problems of unfair discrimination against minority group members, and (3) are linked empirically with occupational performance. A procedure which has demonstrated the potential to make a contribution to these ideals is the use of biographical data which in a number of studies has shown a high degree of promise for obtaining more accurate predictions of college performance and also reducing the problem of "test bias." As reviewed in the next chapter, biographical data has shown substantial validity in predicting academic performance, particularly at the high school level but also at the college level. Of equal importance, in a study of over ten thousand students in one state, blacks had equivalent scores to whites on several biographical inventory scales. Since biographical data has also shown marked validity in studies of the performance of professionals (scientists, engineers, nurses, physicians, managers and executives, etc.), there is also the possibility that such measures may be linked to more ultimate manpower needs of society.

Since admitting a large number of disadvantaged students to colleges and universities of high standards could result in increased failures and thus increase the scope of the present problem, it is important that selection devices be particularly effective among the disadvantaged. This would enhance their probability of success and help in reducing the frustration of failure.

The purpose of this study, then, was to examine the effectiveness of biographical inventory data as a predictor of college performance particularly among the disadvantaged where current college entrance procedures provide less than a satisfactory alternative. In undertaking the study, the intent was not to view the results in terms of yes/no indications for using biographical information in college

selection procedures, but to provide information which different institutions could consider using in a variety of ways depending upon institutional goals, programs, and the groups it was trying to serve. At this juncture, with such rapid social and technological change, a diverse set of strategies should be considered so that different kinds of results and contributions from various educational institutions can be evaluated in terms of an equally broad set of criteria.

Review of the Literature

The current study was concerned with what traditionally has been viewed as purely a selection problem--college admissions. However, selection has been increasingly viewed within the context of social, economic and political considerations including the desire to select more effectively from and provide opportunities for specific groups, i.e., blacks and other minority groups. The following review will include discussions of measurement fairness or bias, traditional means of predicting academic performance, and biographical information as a means of predicting various criteria, including academic performance.

Elements of Measurement Fairness

While measurement fairness with respect to culture and race has become a major point of concern in education and industry, a precise and agreed upon definition of measurement fairness or bias is not easily established. Perhaps one of the reasons for this is, as Thorndike (1971) has pointed out, fairness or bias is not strictly an attribute of a test or a measure but is rather an attribute of the use to be made of the measure. This being the case, any treatment of measurement fairness should integrate technical features of measures with the possible uses of such measurement. When functions other than selection are considered or when the traditional model becomes clouded, then the usually important technical considerations do not exhaust the relevant criteria for measurement fairness.

There is increasing concern that the traditional selection model may be becoming less appropriate in industry (Campbell, Dunnette, Lawler, and Weick, 1970), and certainly in education, where measurement is being asked to support not only selection but placement, diagnosis, feedback, policy research, and the assessment of merit to name a few. However, selection still remains as a major function of measurement data.

Traditional measures of academic achievement (standardized entrance and admissions tests and high school grades), which have provided the primary prediction component of the classical selection model, have been subject to criticism on the grounds of bias against cultural or racial minority groups. The rationale for invoking bias as a criticism is based upon the argument that not enough minorities have been admitted to colleges and universities and since the primary device for making the selection decisions has been the entrance examination, it is the inherently biased entrance

measure which forces biased decisions leading to a lower proportion of minorities in higher education than is socially desirable. It is well documented that blacks score from 1 to 1.5 standard deviations below whites on most existing standardized tests such as those used in selection (Humphreys, 1973). More sophistication than pointing out mean differences on the predictor is required in order to adequately deal with the issue of cultural or racial fairness, however.

A number of characteristics of regression equations, their components, and the consequences of their use must be considered:

- The reliability of the criterion
- The reliability of the predictor
- The validity of the criterion
- The validity of the predictor
- The differential validity of the predictor
- The variance of the criterion for each group
- The variance of the predictor for each group
- The standard error of estimate for each group
- The slope of the common regression line
- The slopes of the regression lines for each group
- The mean score differences between each group on the criterion
- The mean score differences between each group on the predictor
- The intercept of the common regression line
- The intercepts of the separate group regression line
- The selection ratio
- The probability of achieving success

Because some of these factors are interdependent, the total picture becomes more complicated than one to one relationships between bias and technical components of the traditional selection model. Numerous articles have dealt with the impact of the within group reliability of the measures (Linn and Werts, 1971), the standard errors of estimate (Einhorn and Bass, 1971), equal validity and unequal means, differential validity, opposite validity, and no validity in subgroups (Bartlett and O'Leary, 1969), utility assumptions (Einhorn and Bass, 1971), slopes and intercepts of regression line (Thorndike, 1971), and the probability of being selected for college given the probability of success in college (Cole, 1973). While these articles supply the measurement technician with the basis for a better understanding of measurement fairness within the function of selection, they must surely baffle those who are relatively naive concerning the technical aspects of measurement.

Given all of the above treatments of the various factors related

to bias, it is still difficult to answer the question: Are traditional academic achievement tests inherently biased? If it is the end result of the entire selection procedure that is critical and the test is considered only part of this, then the answer would, by definition, be no, for a test by itself cannot be biased. However, if the central feature is that the nature of the test requires some separate treatment of the various groups (different cutting scores or some other set of group specific decision rules), then it may be concluded that the entrance examinations are often inherently biased, since it is usually the case that only through the differential manipulation of other factors that an initial bias can be overcome.

Predictors of Academic Performance

The results for predicting college academic performance generally yield validities comparable to those reported by Hoyt (1968). In a study of 18 colleges using American College Testing service total score and high school grades, Hoyt found median multiple correlations for males to be .59 and .63 for females, although there were "large and important" differences in predictability across the 18 colleges. In Lavin's book on the prediction of academic performance (1965), generally similar results were reported in predicting college grade point average (GPA)--a median correlation of .65[1]

Finger and Schlesser (1965) found that the average correlation coefficient between first semester grades and the College Entrance Examination Board's Scholastic Aptitude Test - Verbal Scale was .40 in a study with a fifty college sample.

Davis (1968) summed up college selection research as follows:

> It would hardly seem to be too much of an exaggeration to say that nearly every investigator of higher education has done a study predicting college achievement or adjustment. It also seems that every investigator has done only one such study.

What is the upshot of all this research on college

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[1]It is of interest to note that according to Lavin, Cronbach's (1949) review showed similar results for ability and achievement measures. In other words, after 20 years of additional research, little or no improvement has been obtained.

selection and guidance? Unfortunately, it can all be summarized rather briefly. The most usual predictors are high school grades and scores on a standardized measure of scholastic aptitude. The usual criterion is the freshman average. The average multiple correlation obtained when aiming the usual predictors at the usual criterion is approximately .55. The gain in the multiple correlation upon adding a personality test score to one or both of the usual predictors, holding the criterion constant, is usually less than .05.

In their review, Pfeifer and Ledlacek (1971) cited a number of studies which found validities for various racial groups of the same order of magnitude as found for a combined sample. In their own study, Pfeifer and Ledlacek (1971) found that black males were less predictable than black females, white females or white males. Still others have demonstrated that differential validity does occur. Cleary (1968) demonstrated that differential validity existed in two out of three schools when the SAT-Math score was used as a predictor. When the SAT-Verbal score was examined, it exhibited differential validity on one out of three schools. When SAT scores were combined with high school average in a multiple predictor format, Cleary found that differential validity remained in one school out of the three. In a study by Stanley and Porter (1967), white females were more predictable than white males, black females or black males. Kallingal (1971) also found significant differential regression for ability tests and achievement test scores in predicting a two year GPA criterion.

Ten of the thirteen institutions studied by Temp (1970) required separate prediction systems for blacks and whites. This study examined the SAT as the predictor and used the Gulliksen/Wilks regression analyses to determine the comparability of the regression systems. The multiple regression coefficients based on the SAT Mathematics and Verbal Scores as predictors and GPA as the criterion were higher for whites in twelve of the thirteen institutions studied. In six schools the multiple regression coefficients for blacks were insignificant, an important finding which will be considered later in this report. Also of interest in Temp's study was the data collection problem, which also hampered the current investigation. Thus, the continued cooperation of participating institutions through the life of studies such as the present one is becoming an increasingly difficult problem. In Temp's study, the number of participating institutions shrunk from 35 to 13 by the time the data were analyzed.

Bowers (1970) found differential validities among male and female groups from special admission and regular admission programs at the University of Illinois. The validity of high school percentile

ranks with GPA was higher on the regular admission freshman sample. The shrunken multiple R with GPA regressed on high school percentile, and the Cooperative School and College Aptitude Tests (verbal and quantitative) was .41 for regular admission male students and .38 for regular admission female students. This was comparable to the 50 college study of Finger and Schlesser (1965). However, the shrunken multiple R's for the special admission students was .22 for males and .24 for females.

The selection of students who can succeed in college (which must be measured by the prevailing though questionable criteria of academic success--GPA--and length of time in the system) but who would ordinarily not be accepted by the traditional admission standards is a major problem of special admission programs. It should be possible to improve selection for these groups since the existing admission tests account for less than half of the criterion variance (when GPA is the criterion), when regular admission students are considered, and less than that for special admission students.

As reviewed in the following section, evidence suggests that objectively scored biographical information provides measurement which attains a high level of validity against criteria for academic success while it also is unbiased for black students. The low level of relationship between biographical information and race plus the high level of validity observed would indicate that objectively scored biographical information would not likely require group specific prediction equations. For example, in a direct analysis of objectively scored biographical information keys in predicting high school GPA, it was found that biographical keys had validities in the .70's for whites and in the .60's for blacks (Murray, Ellison, & Fox, 1973). At the same time, race was only slightly correlated with the BI keys. In most cases, the correlation between race and the predictors was near zero and in all cases it was lower than the correlation between race and the criterion.

Review of Biographical Studies

Though the use of biographical information as a selection procedure has a long and successful history, it has been only relatively recently that extensive systematic research has begun to accumulate. The term biographical information refers to a collection of multiple choice questions (often similar to those found on an application blank) in which an individual describes himself and his background. The rationale in using such an approach is very simple--that past behavior can be used as an indicator of future behavior and performance.

The first use of biographical data as a predictor originated with Goldsmith (1922) when she wrote on "The Use of a Personal History Blank as a Salesmanship Test." Another early example was a study by Bittner (1945), who utilized biographical information to predict college attendance or non-attendance. As early as 1950, Hansen demonstrated that biographical data could be used to predict high school GPA and over- and under-achievement with cross validities as high as .60.

In the majority of biographical information studies, the criteria have involved world-of-work performances such as leadership, creativity, reenlistment, etc., which have been relatively impervious to prediction by more conventional procedures. Such was the nature of studies begun in the late 1950's by the present investigators. These small studies by Taylor, Smith, and Ghiselin (1958) and Ellison (1959) indicated that biographical data had promise for making a significant contribution to the identification of scientific talent. On this basis, a four year study was initiated in 1959 (Taylor, Ellison, and Tucker, 1964; Taylor and Ellison, 1967) to evaluate the effectiveness of biographical data in predicting a variety of scientific performance criteria including supervisory ratings on creativity, quantity of work, etc.; quantity of publications and patents; position; etc. The studies involved over 2,000 scientists and engineers at several NASA research centers. The results showed that creativity and other scientific performance measures could be predicted with biographical data with cross validities ranging from .30 to .59.

Later, three industrial studies on the biographical correlates of scientific and engineering talent at Ethyl Corporation, North American Rockwell, Inc., and Dow Chemical Co. on another 1,000 scientists and engineers confirmed the general effectiveness of biographical data in predicting different criteria of scientific and engineering performance. Included in these studies were measures of creative performance (i.e., publications, patents, supervisory ratings) and a number of job performance criteria other than creativity, such as salary (corrected for education and experience), communication skills, group leadership, breadth of knowledge, etc. (Ellison, James, and Carron, 1968; Ellison, James, McDonald, and Taylor, 1968; Ellison, James, Fox, and Taylor, 1968).

A more recent study (Murray, 1972) examined the utility of biographical information in predicting attrition from U.S. Air Force Training programs and in measuring personality constructs assessed by a standardized personality test. The constructs from the personality test and the biographical inventory were also evaluated and compared in terms of the models of convergent and discriminant validity, factorial validity, and external validity.

Biographical Inventories were administered to 1,235 U.S. Air Force Trainees and item analyzed against a 300 item standardized personality test (the Activities Index) and a training attrition measure. Results indicated that over one half of the personality constructs measured by the Index was also measured by the biographical inventory. The constructs as measured by the biographical inventory were more highly intercorrelated than those of the Activities Index, but were much more externally valid in predicting attrition. This study broadened the conceptual understanding of biographical information in addition to providing further evidence of the validity of the approach in predicting a wide range of criteria.

In order to determine the validity of biographical information in predicting undergraduate academic performance, a new form of the Biographical Inventory, Form J, was developed (IBRIC, 1968). This form included the previously validated creativity items and a number of new items constructed specifically to predict academic performance at the college freshman level.

Form J of the BI was administered to the entire freshman class at Ohio University in November, 1966. The grade point average for the first semester of the freshman year was also later acquired. The sample on which complete data were finally received included 1,525 females and 1,439 males. Item analysis of the BI against the first semester grade point average resulted in cross validities of .60 for females and .58 for males.

In view of the positive results obtained at the college level and because of the availability of a creativity score validated on adult scientists and engineers, interest was generated for a large study of North Carolina high school students. In this study (IBRIC, 1968), a high school version (grades 9 - 12) of the BI (Forms L and M, which were very similar to Form J and the ALPHA form, which was prepared at the conclusion of this study) was constructed and administered to a sample of over 11,000 high school students in North Carolina. The results indicated that the academic performance score was consistently more valid in predicting academic performance criteria--grades and teacher evaluations--than any of the other 24 scores obtained from intelligence tests and achievement measures. Cross validities for the academic performance score on the BI were .70 for white males, .67 for white females, .53 for black males, and .56 for female blacks in predicting rank in class. Equally important, the academic performance score did not show the usual pattern of discrimination in terms of race (a correlation of -.02 was obtained between the BI academic performance score and the binary variable of race, where blacks were coded as 1 and whites as 0). As stated previously, these results showing a lack of racial discrimination are in marked contrast to the usual

predictors of academic performance.

The creativity score, based on the responses of the NASA and industrial scientists and engineers, had a pattern of low to moderate relationships with conventional measures of talent and criteria of academic achievement (e.g., a correlation of .44 was obtained with the SAT total score). Since no relevant creativity criteria were included in the study, it was not possible to evaluate the actual validity of the creativity score for the sample being studied. The correlation of .44 with the SAT in conjunction with the correlation of .22 with high school GPA suggests that the creativity score measures a component of intellectual effectiveness which is not as strongly associated with the more conforming academic achievement measure of GPA. This is supported by studies by Taylor and Barron (1963), Taylor (1964a, 1964b), Hoyt (1966) and others which indicate that GPA measures typically have a low relationship to scientific creativity. The creativity score was also independent of race, with no significant differences between the scores for black and white students.

Subsequent analyses of the North Carolina sample data have been conducted (Ellison, James and Fox, 1970). In this study, new empirical keys were constructed and even higher cross validities for academic performance were obtained on the white sample (.74) and substantially improved results were obtained on the black sample with cross validities in predicting rank in class increased from .54 to .65. As in the earlier study, the biographical keys had only trivial relationships with race while the conventional measures showed the usual pattern of differences between blacks and whites. The biographical keys were again considerably more valid than these conventional measures. The biographical keys were also generally more effective in predicting college attendance than any of the other measures (high school grades, IQ scores, enrollment in college preparatory classes, achievement measures, and family income) included in the study. Information obtained through examination of the biographical correlates of family income (lower self-concepts, lower academic achievement, deprived pattern of activities and interests, etc.) had implications for designing special programs for the economically disadvantaged.

An academic dropout study (Ellison and Fox, 1973) utilized this earlier data bank in conjunction with follow-up data in order to obtain a better understanding of the characteristics which differentiate those students who complete high school and those who do not. Results revealed that a cross validated biographical score was more valid than IQ tests, academic achievement measures, and academic performance in predicting years of education completed, both for whites and for racially mixed groups. For black samples (male, female and total), academic performance was most valid

followed by the biographical score. Results also indicated that placement in vocational courses operated to lower the probability of dropping out of high school for some students.

Results of other investigators have been obtained in a number of institutions which support the potential contribution of biographical data in predicting college performance.

In a study at Wake Forest University, Price (1969) reported that the academic performance score of the ALPHA BI had a validity of .41 against GPA on a sample of 630 freshmen. The SAT Verbal and SAT Methematical had validities of .36 and .31 on the same sample.

A follow-up study of 835 students who, as high school seniors, had completed an early version of the ALPHA BI in the North Carolina study and then entered four year colleges revealed a similar pattern of results (Britt, 1971). The predictive validities of the ALPHA academic performance score in predicting college GPA were .47 for males and .43 for females. The validities for the SAT Verbal and SAT Mathematics scores were .31 and .25 for females and .33 and .25 for males. The validity of high school grades in predicting college grades for these students was .40.

The validity of the ALPHA BI in predicting freshman college GPA for a sample of Mexican American students was investigated in a study which further demonstrated the culture-fairness of biographical information (Abe, 1970). In this study, the validity coefficient of the ALPHA GPA score was higher (.62) than the multiple R of high school rank in class and ACT score (.60). The best prediction was obtained with a combination of two personality measures and the ALPHA GPA key score (R = .67).

The ALPHA BI and keys have also demonstrated their effectiveness within a culture totally removed from that in which they were developed. A Chinese translation of this BI was administered to a sample of Chinese students attending Taiwan universities (Tseng, 1973). In this study, GPA was predicted with cross validities in the .50's for an empirical key and for a priori keys which were developed in the original study of 11,000 North Carolina students.

The results in the above studies were obtained with existing keys constructed originally in the Form J study and then refined in the study on North Carolina 9th and 12th graders for the development of the ALPHA BI. New empirical keys constructed specifically for blacks and whites separately using college dropout and college performance (GPA) as separate criteria could result in improved predictions.

An additional examination of the North Carolina sample data (Fox, 1972) focused on the biographical correlates of race and the interrelationships of these correlates with academic performance criteria and predictors, family income and its life history correlates, correlates of creativity, etc., and dealt with the problem of constructing non-discriminatory selection devices. Only forty-nine biographical items out of 300 were found which had differentiating alternatives on the biographical correlates of race. Correlational analyses indicated that the life history correlates of race generally had low relationships with the academic performance predictors and criteria and that family income and its correlates were consistently more highly related to these other academic predictors and criterion measures than were the biographical correlates of race. It was observed that the degree of bias in biographical information selection devices was largely dependent upon both the nature of the individual items within the instrument and the degree of the relationship of race to the performance criteria to be predicted. With careful item evaluation and selection, forms could be assembled such that empirical scoring procedures and resulting scores would not correlate with race. Further, to the extent that thorough criterion development would result in performance measures which do not discriminate in terms of race, empirical prediction systems would also not correlate with race.

As indicated by this review, biographical information has predicted with a high degree of validity a wide range of criteria, including measures of academic success, without exhibiting the racial discrimination which has been characteristic of traditional instruments used as predictors of academic success. It was upon this background, and because of the need for non-biased college admittance systems which could select black students who not only meet entrance requirements but are able to achieve once they have entered post-high school academic situations, that the current study was undertaken. It is unfortunate that this study could not also have included the analysis and development of criterion measures since, as has been previously discussed, the predictor instrument is only a part of the problem of bias. However, biographical information has demonstrated the potential of measuring non-intellectual variance components in the GPA criterion, such as motivation, attitudes, study habits, etc., which are not measured effectively by college entrance examinations. These and other results suggested that the current study could be conducted with anticipation of reasonable success.

Procedure

The Biographical Inventory

Form ALPHA II of the biographical inventory was the primary predictor instrument used in the present study. This form contained 300 items covering a wide variety of life history aspects including enviromental pressures, attitudes, interests, goals, study habits, home and family characteristics, self-descriptions, etc. ALPHA II was developed on the basis of much previous research with biographical data completed by the Institute for Behavioral Research in Creativity and IBRIC personnel. The most relevant aspects of this previous research were described in some detail earlier in this report. The majority of the items in ALPHA II were taken directly from form ALPHA which, as previously described, has been the subject of extensive research using a large sample of high school students and in several other settings.

After a review of item statistics from previous studies, 217 items from ALPHA were selected for use in ALPHA II. Thirteen items were included which were not available in ALPHA but had demonstrated utility in other forms. Seventy items were constructed especially for the present study. All items were carefully screened, reviewed by test construction experts, and revised where necessary to ensure that the items were appropriate in content and clarity for administration at the college freshman level. In addition, the form was extensively reviewed by black psychologists to ensure that the items were appropriate for black students.

Sample

The sample for this study was drawn from six major universities: three eastern (one of which was predominantly black), two midwestern, and one western. All of these schools maintained some form of a special admission program for students who in general did not meet regular admission standards. In particular, these programs were designed to provide educational opportunities to minorities and/or disadvantaged students.

The initial sample included 1,878 students in the six universities who completed the BI during the 1970-71 and 1971-72 school years. The data from this sample were screened on a number of factors in order to eliminate subjects who did not satisfactorally complete the BI. This included subjects who marked more than 10 responses on a standard answer sheet which did not actually exist in the BI and subjects who failed to respond or made non-existent responses to a total of 30 or more of the BI items (i.e., 10%

or more of the items). In addition subjects were also screened for obviously inconsistent BI response patterns. For example, items 3, 181, and 182 required the subject to indicate his or her sex. An inconsistent response pattern existed when the subject did not indicate the same sex on all items. These screens on the BI resulted in the elimination of 236 subjects. In addition, two students were eliminated on the basis of gross inconsistencies in their criterion data as reported by their universities. The resulting sample contained 1,640 students of which 982 were in special admission programs, 554 were regular admission students, and 104 were students in the black university.

The age characteristics of the sample, as determined from responses to BI item 1, were: 1% age 16, 6% age 17, 44% age 18, 17% age 19, and 33% age 20 or older. Fourty-four percent of the sample was female, 56% was male.

Data Collection

The students were administered the ALPHA II BI while at their respective universities. The BI was administered to the majority of the sample in the fall of the 1970-71 school year. In an attempt to increase the sample size, administrations were conducted later that school year and early in the following year; however, only small amounts of data were collected at these times. The conditions of administration were not highly structured. Students were allowed to complete the BI at home if they did not have time in the special sessions provided.

Because special admission students, especially minority group members, were believed to be potentially the most sensitive about participating in the study, special attention was given to collecting data from the special admission programs. Personal contacts were made to explain the study and enlist the cooperation of the directors of these programs in each school. Arrangements were made with admission or other officials for the collection of data from regular admission students. The outcome of this procedure was that more data were obtained from special admission programs than from regular admission groups. Despite follow-up contacts with these and other potential institutions, the sample of regular admission students was smaller than desired.

Criterion data were obtained through the cooperation of the admissions offices of the participating institutions. The data requested included freshman GPA, accumulative GPA, and accumulative hours completed (quarter or semester). In addition, the admission offices were asked to provide admission test scores (SAT or ACT),

high school rank in class, and/or high school GPA. Unfortunately these data were rarely complete. Entrance test scores, especially, were reported in a sporadic fashion and no information was provided as to the kind of sampling distortion that could be associated with the availability or non-availibility of these scores. In addition, within institutions different entrance tests and methods of reporting scores were used. In view of these problems, it was decided that test scores from only one university where almost complete data were obtained would be used in the present study. One institution declined to provide any criterion data.

A description of the final sample after the data were screened and the amount of data available on several of the major variables are presented in Table 1. Inspection of the table indicates that although there was some complexity in terms of institutions versus data available (e.g., blacks came primarily from universities A and B while regular admission students were primarily from university F), reasonably useful data were obtained, except on entrance test scores. Since there has been extensive research on these types of measures, as reviewed in the survey of the literature, this was not considered a serious problem.

Criterion Variables

As previously described, the primary criterion data collected from the universities included freshman GPA, accumulative GPA, and accumulative hours completed (quarter or semester). Based upon these data, four criterion measures were developed. The first criterion was a transformed hours completed measure based upon the accumulative hours completed data from all participating schools. A transformed score was required for the following reasons: (1) some of the schools were on a quarter system while others were on a semester system and (2) unequal time periods had elapsed between collection of the BI data and collection of the criterion data.

One alternative for transforming these data to form a criterion was to standardize means and variances of the accumulative hours variable within schools. While such a procedure would have dealt with the two problems raised above, it would have been an inadequate solution as the sample consisted of both special and regular admission students and the ratio of special admission students to regular admission students varied considerably from school to school. A standardization of both means and variances would have eliminated true differences between both schools and the special and regular admission groups.

The transformation which was used to form the hours completed criterion involved three steps, the first of which was to adjust

TABLE 1

N's for Each University and the Total Sample

on Several Categories of Students and Variables

	Univ. A	Univ. B	Univ. C	Univ. D	Univ. E	Univ. F	Total Sample
Total N	176	315	104	81	134	830	1640
Black	103	172	54	75	12	13	429
White	17	79	3	2	119	736	956
Chicano	26	35	1	1	0	31	94
Special Admissions	176	239	0	81	37	449	982
Regular Admissions	0	76	0	0	97	381	554
High School Rank	102	197	0	43	0	0	342
High School GPA	0	27	0	0	0	653	680
Entrance Test Scores	0	0	0	0	0	602	602
Class Hours Completed*	110	234	0	52	127	602	1125
College GPA	0	285	0	79	130	802	1296
All BI Scores	176	315	104	81	134	830	1640

*The 333 students who were non-freshmen (based on their response to item 2) were given missing data for this variable and the composites based on it.

within universities and admission categories, the scores of each group with a shorter time lapse to yield a mean equal to that of the corresponding group with a longer time lapse. This was accomplished by multiplying the scores of those with the shorter time lapse by the ratio of the larger mean to the smaller mean.

The second step of the transformation was simply to multiply the accumulative hours completed of all students who were on the semester system by a factor of 3/2. While this did not equate the means for the accumulated hours variable, it did correct for the differences in the systems without tampering with any "real" difference between the schools.

The mean number of hours for each school as it existed after step 2 was retained through step 3 which consisted of a transformation to standardize, within schools, the variability of the accumulative hours completed. Since one school made up 51% of the sample, the variability in each other school was standardized to equal the variability in the larger school. This transformation was accomplished by multiplying the accumulative hours scores in each school by a factor specific to the school. In order to retain mean scores resulting from step 2, a constant value for each school was subtracted from the scores after the multiplication to standardize the variability.

These transformations, which resulted in the final hours completed criterion, were necessary to retain, where possible, meaningful group differences between regular admission and special admission students. Any simple standardization would have disrupted these differences because of the intentional nonrandom nature of sampling and differing proportions of special admission and regular admission students across schools.

The second criterion variable was college GPA which for some of the subjects was freshman GPA only since they had only completed one year. In these cases, freshman GPA was equivalent to accumulative GPA. Consideration was given to standardizing the means and variances of GPA within schools; however, it was felt that such a procedure would have eliminated true differences between both schools and the special admission and regular admission groups. While the decision not to standardize possibly created some restriction on the use of accumulative GPA as a criterion for the total sample, it was felt that these restrictions would be preferable to making assumptions about what GPA differences should be expected to occur between special admission and regular admission students. Such assumptions would have only served to contaminate results relating to differences between special admission and regular admission students.

The third criterion was an equal weight composite of GPA and the hours completed criterion. The fourth criterion was a binary success measure based upon GPA and hours completed as it existed after the second step of the transformation. On this criterion, all those whose hours completed (after step 2) was greater than 12 and whose GPA was greater than 2.00 were given a score of 2; everyone else was given a score of 1. Binary success was then a crude success versus fail measure.

Other Variables

Three outside predictors examined in the study were high school grade point average, high school rank in class, and the ACT composite score. This latter score was available only on university F.

Several control scores were included in the analysis. In general, these were binary scores based upon group membership. By examining the correlation of such a binary score with a criterion or predictor score, differences in the relative standings of the two groups (the basis of the binary score) on the criterion or predictor score may be seen.

In order to examine institutional differences, six binary scores based on school attended were created. The first of these six variables has subjects attending university A coded 2 and all other students coded 1; the next variable has students in university B coded 2 and all other students coded 1; etc. Thus, by examining the appropriate correlations, one could determine if students in any particular school were significantly different from the others on any of the other measures.

Binary variables were also created to permit comparison on the following classifications: male versus female (based on responses to BI item 3 with females coded 1 and males coded 2), black versus white (BI item 298 with blacks coded 1 and whites coded 2), chicano versus white (BI item 298 with chicanos coded 1 and whites coded 2), and special versus regular admission (based on school classification with special admission coded 1 and regular admission coded 2).

Scaled control scores for family income and level of parental education were also created. The family income score was based on the individual's response to BI item 299 and was scaled as follows:

1 = income less than $4,000 per year
2 = income from $4,000 to $6,999 per year
3 = income from $7,000 to $9,999 per year
4 = income $10,000 or more per year

The parental education score was defined by the individual's responses to BI items 26 through 28 and was scaled as follows:

1 = neither parent graduated from high school
2 = neither parent attended college
3 = at least one parent attended college
4 = at least one parent graduated from college

One thrust of the study was the validation of pre-existing ALPHA BI scoring keys. Table 2 lists these keys and the number of items in each. All keys were derived from empirical item analyses using a sample of North Carolina high school students (IBRIC, 1968). The validities of these keys in the present study supplied information on validity generalization, as a new sample and a new set of criteria were employed.

TABLE 2

Pre-existing ALPHA BI Keys Used in Validation

KEY	NUMBER OF ITEMS
Total Sample GPA	81
Black GPA	75
High School Completion	39
Family Income	69
Male Race	14
Female Race	22

Subsamples

Various subgroups were maintained separately for the data analysis. This was done to check for differential validity between groups. Table 3 lists the subsamples examined, the number of subjects in each group, the percentage that number was of the total sample, and how the subsample was defined.

TABLE 3

Subsamples

Subsample	N	%	Definition
Regular Admission	982	60	School Classification
Special Admission	554	34	School Classification
Female	707	43	BI Item 3, Response A
Male	926	56	BI Item 3, Response B
Low Income	477	29	BI Item 299, Responses A & B
Low Parental Ed.	310	19	BI Items 26 & 27, Response A
Black	429	26	BI Item 298, Response C
White	956	58	BI Item 298, Response D

Data Analysis

In order to estimate the validity of the BI in predicting the various criterion measures of academic performance, an item analysis was carried out in a double cross validation design. For the item analysis, the total sample was divided randomly into two samples--odd and even. Each sample was then item analyzed separately to establish scoring weights for the items which differentiated between various levels of performance on each of the criterion measures. These item weights were then used to score the BI's of the students

in the other sample in order to determine the effectiveness of the instrument on an independent group.

More specifically, biserial and point biserial correlations were computed for each alternative of each question with each criterion on the odd sample. After these correlations were computed, all were screened for statistical significance. A scoring key was then generated for each criterion consisting of all alternatives which had significant biserial correlations with that criterion. The alternatives with significant positive correlations were weighted plus 1 and those with negative correlations were weighted minus 1. The scoring keys for each criterion were then used to score the responses of the subjects in the even sample. Conversely, the even sample served as a means of developing another set of scoring weights which were applied to the odd sample.

The reason for this method of analysis is that the use of the same group (the total sample for instance) for both the development of the scoring weights and the application of these weights usually produces results which are spuriously high and thus fail to give a satisfactory estimate of the effectiveness of the instrument. Cross validation of the scoring keys on a separate sample provides an estimate of the effectiveness of the procedure on another, independent group.

The double cross validation design used in the present study generally provides two estimates of the cross validity. However, in the present study, a different procedure was utilized to simplify the presentation of the results. The cross validities for the total sample and all subsamples were obtained by merging the results of both cross validation analyses. The keyscores obtained for each student from one of the two cross validation runs were merged with his criterion scores and all other variables. Intercorrelation matrices were then computed on the total sample and all subsamples.

The biographical keys and correlation matrices were generated in one run on the University of Utah Computer Center's Univac 1108, utilizing a program developed by personnel of the Institute for Behavioral Research in Creativity and the University of Utah Computer Center. In addition to the keys, the item analysis output from the program included for each BI item within each sample, the percentage of individuals choosing each item alternative, the actual number of individuals responding to each alternative, and the criterion mean for those individuals who selected each alternative. The program also provided the biserial and point biserial correlations of each item alternative with the criterion and the standard error for the biserial together with the eta coefficient of the total item continuum with the criterion and the standard error of the eta. The program allows the flexibility of handling a large number of samples at one

time; thus, the double cross validation item analysis and scoring design and the correlation analyses on the total sample and all subsamples were accomplished in the same run.

In the construction of a scoring key for the analysis of biographical data to predict an outside criterion, the emphasis is usually placed on obtaining a high cross validity coefficient for the key in predicting that criterion on an independent sample. This in turn is a function of at least four parameters: (1) number of items; (2) the magnitude of the correlations of individual item alternatives with the criterion; (3) the expected stability of the item alternative-criterion correlation which in turn varies with the significance level; and (4) item heterogeneity. In the analysis of the present data, different strategies for item scoring, and retention in scoring keys, were used in order to obtain keys which would produce high cross validity coefficients.

The criteria used for item analysis were hours completed, total sample GPA, GPA for females only, GPA for males only, GPA for the low income sample only, and the equal weight composite of hours completed and GPA. The first standard used for keying alternatives in the item analysis required that 5% or more of the sample respond to the alternative and that the biserial correlation between the alternative and the criterion be greater than or equal to an absolute value of .20. Positively correlating alternatives were weighted +1, and negatively correlating alternatives were weighted -1. Criteria which used this standard were hours completed, GPA, and the equal weight composite of hours completed and GPA. This was a rigorous standard (beyond what was required for the .01 level of confidence) for these criteria which had large N's and emphasized relatively high item alternative criterion correlations.

The second standard was simply to key alternatives for which the biserial correlation between the alternative and the criterion was greater than 1.96 times the standard error of the biserial. This standard ensured significance beyond the .05 level when generating keys against GPA for females only, GPA for males only, and GPA for low income students only, all of which had comparatively large amounts of missing data. This strategy emphasized item heterogeneity, rather than a more limited number of items with higher criterion correlations as in the first strategy.

Table 4 lists the number of items with keying alternatives for each key generated in each of the key generation samples.

TABLE 4

Number of Items in Each Key

KEY	ODD SAMPLE	EVEN SAMPLE
Transformed Hours Completed	42	21
GPA	53	58
Female GPA	126	130
Male GPA	125	140
Low Income GPA	107	98
Equal Weight Composite	66	48

Results

In the presentation of the results, the correlational analysis of the total sample is given first, followed by those for the regular and special admission groups, females and males, the low income and low parental education samples, blacks, and whites.

Total Sample Analysis

The means and standard deviations for all variables analyzed on the total sample are presented in Table 5. The mean of 77.34 on variable 1 (high school rank) indicated that students for whom these data were available were generally above the average of other high school graduates in their class. Comparable information is not available for variable 2 (high school GPA) or for any of the college criteria. The means of the control variables (7 through 18) reflect the sample descriptions presented earlier. Since the BI keys were based on a somewhat different item pool, their means and standard deviations are not comparable to those from previous studies.

The intercorrelations presented in Table 6 will be discussed in terms of five categories. Variables 1 and 2 assessed high school performance; variables 3 through 6 concerned college performance criteria; variables 7 through 18 were control variables; variables 19 through 24 were a priori keys derived from previous research; and variables 25 through 30 were the empirical keys constructed during this study.

The first category of variables included high school rank and high school GPA which were obtained and analyzed separately because there was no information about how the students with rank data compared with students who had GPA data. Since these variables involved subjects selected in an unknown way by different institutions, differences in the way these variables correlated with other variables were due not only to different samples but also to institutional differences. Generally, the relationships of high school rank and high school GPA with other variables tended to be similar although there were a number of important exceptions. Both had moderate relationships with hours completed but high school GPA was more highly related to the college GPA criterion than was high school rank. These validities of approximately .50 for the high school performance measures were what would be expected on the basis of previous research and represented a standard to which the validities of the biographical data may be compared. High school rank and GPA were approximately equally effective in how they related to variables 5 and 6 (the GPA-hours composite and binary success measures) with rank tending to be slightly more predictive of the

TABLE 5

Means and Standard Deviations of Variables Used in the Total Sample Analysis

VARIABLE DESCRIPTION	MEANS	STANDARD DEVIATION
1. High School Rank	77.34	10.77
2. High School GPA	2.45	.66
College Criteria:		
3. Hours Completed	48.77	31.78
4. GPA	2.34	.85
5. GPA-Hours Composite	4.66	1.50
6. Binary Success	1.65	.48
Control Scores:		
7. Univ. A=2; other=1	1.11	.31
8. Univ. B=2; other=1	1.19	.39
9. Univ. C=2; other=1	1.06	.24
10. Univ. D=2; other=1	1.05	.22
11. Univ. E=2; other=1	1.08	.27
12. Univ. F=2; other=1	1.51	.50
13. 1=female; 2=male	1.57	.50
14. 1=black; 2=white	1.69	.46
15. 1=chicano; 2=white	1.91	.29
16. Family Income	2.88	1.10
17. Parental Education	2.61	1.10
18. 1=special; 2=regular	1.36	.48
A Priori ALPHA Keys:		
19. Total Sample GPA	102.61	13.62
20. Black GPA	102.50	12.68
21. High School Completion	104.90	5.46
22. Family Income	104.25	11.85
23. Male Race	100.77	2.42
24. Female Race	99.40	3.05
Empirical Keys:		
25. Hours Completed	101.78	4.86
26. GPA	103.60	9.63
27. Female GPA	97.53	13.88
28. Male GPA	104.05	14.45
29. Low Income GPA	102.58	10.78
30. Composite	103.33	9.80

TABLE 6

Intercorrelations and Corresponding Sample Sizes for Variables Used in the Total Sample Analysis

Variable Number and Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1. High School Rank	--	000	255	225	168	168	342	342	342	342	342	342	339	268	113	252	340	342	342	342	342	342	342	342	342	342	342	342	342	342
2. High School GPA	00	--	570	680	570	570	680	680	680	680	680	680	678	614	619	569	677	680	680	680	680	680	680	680	680	680	680	680	680	680
College Criteria:																														
3. Hours Completed	44	39	--	1015	1015	1015	1125	1125	1125	1125	1125	1125	1121	972	789	904	1122	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125
4. GPA	20	53	53	--	1015	1015	1296	1296	1296	1296	1296	1296	1291	1161	971	1063	1291	1296	1296	1296	1296	1296	1296	1296	1296	1296	1296	1296	1296	1296
5. GPA-Hours Composite	52	49	87	88	--	1015	1015	1015	1015	1015	1015	1015	1012	901	756	819	1012	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015
6. Binary Success	32	42	54	75	74	--	1015	1015	1015	1015	1015	1015	1012	901	756	819	1012	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015	1015
Control Scores:																														
7. Univ. A=2; other=1	-06	00	-01	00	00	00	--	1640	1640	1640	1640	1640	1633	1385	1050	1310	1633	1536	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640
8. Univ. B=2; other=1	28	05	06	20	18	16	-17	--	1640	1640	1640	1640	1633	1385	1050	1310	1633	1536	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640
9. Univ. C=2; other=1	00	00	00	00	00	00	-09	-13	--	1640	1640	1640	1633	1385	1050	1310	1633	1536	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640
10. Univ. D=2; other=1	-34	00	-04	02	-05	-01	-08	-11	-06	--	1640	1640	1633	1385	1050	1310	1633	1536	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640
11. Univ. E=2; other=1	00	00	-07	16	07	21	-10	-15	-08	-07	--	1640	1633	1385	1050	1310	1633	1536	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640
12. Univ. F=2; other=1	00	-05	02	-28	-18	-28	-35	-49	-26	-23	-30	--	1633	1385	1050	1310	1633	1536	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640
13. 1=female; 2=male	-04	-34	-07	-20	-17	-19	-09	-08	02	-09	-08	19	--	1378	1045	1304	1626	1529	1633	1633	1633	1633	1633	1633	1633	1633	1633	1633	1633	1633
14. 1=black; 2=white	42	06	09	-09	-02	-09	-37	-38	-29	-35	15	69	19	--	956	1142	1379	1328	1385	1385	1385	1385	1385	1385	1385	1385	1385	1385	1385	1385
15. 1=chicano; 2=white	50	16	05	05	05	03	-37	-27	-04	-05	11	28	03	00	--	899	1048	1046	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
16. Family Income	17	16	07	01	05	01	-29	-25	-07	-13	10	39	08	51	35	--	1309	1242	1310	1310	1310	1310	1310	1310	1310	1310	1310	1310	1310	1310
17. Parental Education	12	09	08	03	06	01	-21	-20	-12	-13	11	34	03	43	38	50	--	1530	1633	1633	1633	1633	1633	1633	1633	1633	1633	1633	1633	1633
18. 1=special; 2=regular	45	73	25	30	31	29	-27	-13	00	-18	23	22	-04	47	29	37	31	--	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536
A Priori ALPHA Keys:																														
19. Total Sample GPA	43	66	31	44	43	36	-04	06	11	06	10	-15	-23	01	17	07	12	37	--	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640
20. Black GPA	38	65	28	41	40	34	02	08	16	11	07	-24	-27	-11	10	-02	02	30	94	--	1640	1640	1640	1640	1640	1640	1640	1640	1640	1640
21. H. S. Completion	35	66	29	37	38	33	-02	03	10	11	12	-18	-20	-01	17	09	13	36	86	86	--	1640	1640	1640	1640	1640	1640	1640	1640	1640
22. Family Income	31	43	20	27	26	21	-13	-08	-06	-04	14	11	02	27	30	34	41	41	70	57	60	--	1640	1640	1640	1640	1640	1640	1640	1640
23. Male Race	18	09	17	10	16	09	-18	-18	-13	-12	16	27	21	44	31	36	38	34	09	-01	12	40	--	1640	1640	1640	1640	1640	1640	1640
24. Female Race	16	20	15	08	13	09	-17	-21	-16	-10	16	31	-05	42	26	32	30	34	-06	-16	-04	17	57	--	1640	1640	1640	1640	1640	1640
Empirical Keys:																														
25. Hours Completed	46	67	31	43	43	35	-07	04	05	01	14	-10	-21	14	13	13	11	43	74	72	71	45	15	04	--	1640	1640	1640	1640	1640
26. GPA	48	71	32	50	48	42	05	13	08	05	18	-29	-41	-07	09	02	06	37	86	83	74	55	06	-01	76	--	1640	1640	1640	1640
27. Female GPA	41	51	26	44	39	35	00	10	08	03	15	-22	-09	-01	10	03	09	31	80	73	63	65	12	-04	66	82	--	1640	1640	1640
28. Male GPA	50	64	33	50	49	41	01	13	10	05	17	-27	-16	-05	12	03	07	37	84	78	69	63	14	01	70	88	84	--	1640	1640
29. Low Income GPA	32	49	23	40	37	35	11	16	08	10	15	-36	-40	-21	00	-09	02	19	66	65	57	40	01	-04	59	81	74	68	--	1640
30. Composite	49	69	33	50	48	42	02	12	09	05	17	-27	-34	-06	09	04	06	37	85	82	75	54	09	00	86	94	80	85	77	--

Note: Decimal points omitted

GPA-hours composite but less predictive of the binary success measure.

High school rank and high school GPA tended to have generally low relationships with most of the university classification variables except that students from university B (variable 8) did tend to have higher high school rank scores than did students from the other universities, while students from university D (variable 10) were lower in high school rank than the other students in the study.

The control variables (13 through 18) did tend to have some marked relationships to high school rank and high school GPA. The fact that blacks and chicanos (variables 14 and 15) had lower high school rank scores than did whites is particularly noteworthy. Since the black and the chicano samples were generally well represented on the high school rank measure but not on the high school GPA measure, the same relationship did not hold for high school GPA. Both high school performance measures had low relationships with family income (variable 16) and parental education (variable 17) measures, but had strong relationships with the special vs. regular admission variable (number 18). High school performance has been one of the principal measures used in qualifying students for special admission programs.

Both high school performance measures demonstrated a range of relationships with the BI keys. The keys that were built to predict academic performance criteria correlated at least moderately and sometimes very substantially with the high school performance measures. For example, the a priori total sample GPA key (variable 19) correlated .66 with the high school GPA measure, a substantial degree of relationship. At least moderate relationships with the high school performance measures were obtained with other biographical keys including the GPA key constructed on blacks (variable 20), the key constructed to predict the completion of high school (variable 21), and the key constructed to identify the correlates of family income. The keys constructed to identify the biographical correlates of race (variables 23 and 24) both had low relationships to the high school performance measures, slightly higher with rank in class than with GPA where little data was available on minority groups, as stated previously. The high school measures had substantial relationships (correlations as high as .71) with the empirical keys (variables 25 through 30) constructed in this study to predict college performance.

The second category of variables (3 through 6) concerned the primary criteria of the study, that is, the college performance measures. These measures were generally fairly highly interrelated, correlations ranging up to .88 for part-whole relationship between GPA-hours composite and the GPA measure. The hours completed criterion (variable 3) correlated .53 with the college GPA measure, .87 with the GPA-hours composite, and .54 with the binary success measure. The college GPA measure (variable 4) correlated similarly with the GPA-hours composite but was more highly

related (.75) to the binary success measure.

These criteria generally had low relationships with the school variables (7 through 12) with two exceptions. The correlations with variable 8 indicated that university B had students participating in the study who had somewhat higher GPA's than the others, either because of more lenient grading practices or other factors. The correlations of variable 12 (students from university F) with the college criteria indicated that these students, as a group, scored lower on the college criteria resulting in correlations of -.28 for the college GPA measure and the binary success measure. Since these relationships were relatively low, this indicated that combining the various universities into one sample without standardization did not result in any marked institutional differences on the criteria. As previously discussed, the alternative of standardizing the criteria was not feasible; furthermore, some of these institutional differences which did appear were also reflected in the BI key scores, as discussed later, which further supported the decision not to standardize the college criteria.

The college criteria tended to have generally low relationships with the other control variables except for the special vs. regular admission variable (number 18) where the correlations were generally in the .20's but up to .31 with the GPA-hours composite criterion. The relationship of variable 4 (college GPA) with the sex variable indicated that males tended to have lower GPA's than females. The low correlations with the race and family income measures (variables 14, 15, and 16) indicated that, contrary to expectations, there were little differences in the college performances of the students when they were classified in terms of these measures (e.g., blacks tended to have approximately the same GPA as whites). However, the marked relationship of the college performance criteria to the special vs. regular admission classification measure (variable 18) indicated that those students coming into the university under special programs did not tend to do as well in college as those students who met regular admission standards. Since the other measures of the disadvantaged classification--family income, parental education, and race--did not show anything other than essentially zero relationship with the college criteria, the results thus far discussed indicated that high school performance was the important indicator of later college performance for the total sample. However, as reviewed later in this report, some of these control measures, such as family income, may have been weak or influenced by situational factors.

The hours completed criterion (variable 3) was predicted by the biographical keys with validities in the .20's and .30's. The a priori ALPHA keys approximated the validity of the empirical keys which were specifically constructed in this study to predict this criterion. In particular, the a priori total sample GPA key (variable 19) had a

validity of .31 with hours completed while the empirical key specifically constructed to predict that measure (variable 25) also had a correlation of .31. Since keys constructed to predict other criteria were as effective or more effective in predicting hours completed, these results suggested that the criterion itself was relatively impervious to prediction.

The college GPA measure was clearly more predictable than the hours completed criterion. With this measure there were differences between the a priori key and the empirical keys specifically constructed in this study. The highest validity for an a priori key was from the total sample GPA key (variable 19) which had a validity of .44 while three empirical keys (the GPA key, the male GPA key, and the GPA-hours composite key) all had validities of .50. These validities are of the same order of magnitude as those obtained for high school GPA, indicating that the biographical measures were generally as effective as the high school performance measures for GPA on the total sample.

It should be noted that the college GPA criterion generally correlated lower with the BI keys than did the high school performance measures which, to some extent, reflected the post-dictive vs. predictive nature of these measures in relation to the BI keys. However, since the high school performance measures also correlated higher with the control variables of male vs. female, black vs. white, chicano vs. white, etc., as well as the BI keys, a supplementary possibility is that college grades may be more heterogeneous which could make the measure less sensitive as it relates to other variables.

Variables 5 and 6, both of which involved hours completed and college GPA, tended to have a range of correlations with the keys that varied between those for hours completed and college GPA with the GPA-hours composite being the more predictable.

In the third category of the matrix, the university variables (7 through 12) differed slightly in their relationships to the other control variables.[2] The correlations with sex were generally trivial except that university F (variable 12) did have slightly more males than the other universities in the sample studied. Also, university F had considerably more whites whereas universities A, B, C, and D tended to have a larger percentage of blacks and chicanos (variables 14 and 15) in the sample studied. Universities A and B also tended to have students who were lower on family income whereas university F (variable 12) had

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[2] These relationships reflect the binary coding of the variables; more accurate interpretations of these data can be obtained from the information presented in the Procedure section of this report.

more students with above average income. A similar pattern was also true of parental education.

Correlations of the schools with variable 18 indicated the percentage of special vs. regular admission students from each institution. These correlations indicated that the university A (variable 7) sample was predominantly special admission students while universities E and F (variables 11 and 12), in comparison to the other schools, had a larger percentage of regular admission students participating in the study.

Variable 19 (the total sample GPA key), when correlated with the university variables, indicated that students at the various institutions were generally similar with the exception of university F (variable 12) which scored below the total sample average on this biographical measure. The correlation of -.23 for university F and the total sample GPA key compares generally with the correlation mentioned previously of -.28 between university F and college GPA. This is a rather striking demonstration that the key was very sensitive to differences in students as the a priori total sample GPA key paralleled the criterion relationships even though the key was built on high school students. This same pattern held on other a priori keys including the black GPA key and the high school completion key and was also true on the empirical keys except that the correlations were typically more marked. This same phenomenon, however, did not hold for university B subjects (variable 8) as they generally were average in their scores on the biographical keys even though they had a higher college GPA score (the correlation between variable 4 and variable 8 was .28). This suggested that grading practices may have been more lenient in university B.

The correlations of the university variables with the family income key and race keys tended to parallel, although they were lower, the correlations obtained between the university variables and the measures of family income and number of blacks and whites attending these universities. For example, university F was above average in family income and also was above average on the family income key. Also, university F, which had the highest percentage of whites, scored highest on the male and female race key, indicating the construct validity of these keys assessing the biographical correlates of race.

The correlations of the university variables with the empirical keys were generally similar to those with the a priori keys with university F again scoring lower on all keys.

The correlations of sex (variable 13) with other measures not previously mentioned were generally inconsequential except for the correlation between sex and BI keys where males consistently scored

lower. Since they also scored lower on the criteria, this was to be expected.

Correlations among variables 14 through 18, the control variables concerned with various indices of disadvantaged status, tended to be moderate and ranged between .29 and .51. These correlations indicated that using family income, parental education, or university classification did not result in highly similar classifications of subjects as disadvantaged. Stated alternately, the classification of disadvantaged is complex, having relatively independent components. In view of this complexity, various subsamples were analyzed separately as indicated in the procedure section.

The correlations of variables 14 through 18 with the a priori ALPHA academic performance keys were generally low and indicated that being black, chicano, or of low family income, etc., resulted in only small or non-existent differences in BI scores. To illustrate, a particularly noteworthy correlation was that between variable 19 (the total sample GPA key) and variable 14 (black vs. white) which was .01. This confirmed the previous research finding that the biographical keys designed to predict academic performance were unrelated to race when black-white differences are concerned. The total sample GPA key did correlate (.17) with white vs. chicano and barely with family income and parental education although the correlations were low (.07 and .12 respectively). The most marked relationship in this section concerned the correlation between variable 18 (special vs. regular admission student) with the BI keys. Here the relationships were in the .30's, indicating that regular admission students did tend to score above average on these BI keys, differences which were also reflected in the college performance criteria.

The construct validities of the family income key and the race keys were strongly indicated by the relationships these variables had with variables 14 through 18. Here, all the correlations were markedly positive (.20's, .30's, and .40's) which indicated a convergence of predictor and criterion data in terms of what these variables measure.

The relationships of variables 14 through 18 with the empirical keys were generally similar to those of the a priori academic performance keys. The most marked relationships were again with the special vs. regular admission variable (variable 18).

The correlations of variable 14 (black vs. white) with the empirical keys were of special interest. While the empirical key constructed to predict hours completed did correlate slightly positively with this measure, indicating that whites scored slightly higher, the balance of the empirical keys constructed in this study correlated in a slightly negative direction, indicating that blacks tended to score slightly

higher than whites. A pattern of very low but, in this case, positive correlations were found for the chicano vs. white variable (variable 15). These findings were certainly in marked contrast to standardized achievement tests and, in the present study, with the high school performance measures as well.

The balance of the matrix not previously discussed concerns intercorrelations among biographical keys. Generally, the correlations among keys constructed or designed to predict academic performance were all high, ranging from the .60's through the .90's. However, the correlations between the race keys and the academic performance keys were considerably lower, often nearly zero, indicating the heterogeneity and independence of biographical data.

The only other findings of interest in these key intercorrelations were the relationships between the family income key and the academic performance keys, which often tended to be high. For example, the family income key (variable 22) correlated .70 with the a priori total sample GPA key. A relationship of this magnitude suggests that those life history attitudes, experiences, value systems, etc., which are associated with higher economic levels also characterize the life history correlates of students who are more likely to score high on the academic performance keys and (from evidence previously presented) do well in college. Further discussion of this phenomenon is presented later in this report.

Analysis of Results for the Special and Regular Admission Samples

As described in the procedure section, separate analyses were carried out for special admission students and regular admission students. The intercorrelations for these samples are presented in Table 7.[3] Three variables, the ACT composite, college GPA for females only and college GPA for males only, included in this table were not presented in the total sample matrix. Including college GPA for males only and for females only made it possible to examine validities for

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[3] The sample sizes for these intercorrelations involved an N of 982 for the special admission sample and an N of 554 for the regular admission sample. However, for certain variables the N was restricted by missing data. Only 280 subjects had percentile rank data in the special admission sample (95 females and 68 males) and only 62 had similar data in the regular admission sample (19 females and 41 males). Other data was generally based on an N of approximately 200 or more. Since the focus in these subsamples was not on statistical significance per se but rather on the relative level of correlations, detailed data on the sample sizes will not be presented.

TABLE 7

Intercorrelations of Selected Variables

Regular Admission Students Upper Right, Special Admission Students Lower Left

Variable Number and Description	1	2	3	4	5	6	7	8	9	10	11	12
1. High School Percentile Rank	--	00	00	30	39	60	29	48	51	39	47	57
2. High School GPA	00	--	32	36	51	59	43	47	32	27	56	55
3. ACT Composite	00	20	--	27	34	40	38	33	23	36	49	33
4. Class Hours Completed	25	05	22	--	50	43	54	90	44	22	34	31
5. College GPA	10	18	31	50	--	100	100	83	71	30	49	45
6. College GPA females only	11	16	36	46	100	--	00	80	66	32	53	42
7. College GPA males only	02	18	30	52	100	00	--	85	74	29	44	45
8. GPA-Hours Composite	31	15	30	85	88	87	89	--	65	29	47	44
9. Binary success	23	14	23	56	73	70	74	75	--	18	28	28
10. Family Income Key	11	16	34	05	10	16	07	08	06	--	67	56
11. Male GPA Key	36	24	34	23	41	38	38	38	37	53	--	81
12. Composite Key	36	35	26	23	43	35	40	39	39	41	84	--

NOTE: Decimal points omitted

predicting college GPA by sex within admission classifications. Since Bowers (1970) found significant differences in regression coefficients using high school percentile rank and the Cooperative School and College Ability Tests (SCAT) to predict first semester GPA for all four possible groups combining sex and admission classification, possible differences in the data warranted this treatment.

In addition to adding the above three variables to the analysis of the special and regular admission samples, several variables were dropped to simplify the analysis. Variables dropped were the control variables, which would have been largely redundant in view of the other analyses, and all but three of the BI key scores. Since the BI keys developed to predict academic performance were highly intercorrelated it was not necessary to look at all of them within the selected subsamples.

In the special admission sample, the validities of the high school performance measures in predicting the college criteria were particularly low. The highest validity in this sample for predicting college GPA (males, females or combined sexes) was only .18. In contrast to this lack of validity of the high school performance measures, the male GPA key and the composite key from the BI had validities of approximately .40. Only for hours completed were the validities of the BI keys relatively low (.23).

The results of the high school performance measures in the special admission sample contrasted sharply with those in the regular admission sample where the highest validities in predicting college GPA were .60 for females, .43 for males, and .51 for both sexes combined. The ACT composite score was about equally valid for the regular admission group (r's from .23 to .40 vs. .21 to .36 for the special admission sample). In the regular admission sample, the BI keys had validities somewhat higher than the ACT composite but somewhat lower than the high school performance measures against GPA for females, while for males the validities were of about the same magnitude (with a slightly higher validity for the male GPA key). In general, the BI keys were more valid in the regular admission sample than in the special admission sample, although the differences were small.

Across both samples, differences in validity against GPA for males and females were generally small, with females tending to be more predictable than males. The most marked example of differential validity against GPA occurred with the high school performance measures in the regular admission sample; however, the sample sizes on which these correlations were based were quite small. The male GPA key was equally valid (.38) for both sexes in the special admission sample and more valid for females than males in the regular admission sample (r's of .53 and .44, respectively).

Analysis of Results for the Male and Female Samples

The intercorrelations of selected variables for males and females are presented in Table 8.[4] The variables in Table 8 are the same as those in Table 7 with the exception of the deletion of male and female GPA and the addition of a binary variable contrasting the special admission group with the regular admission group. While Table 7 did allow for an examination of sex differences, it did so only as nested within the special admission sample and the regular admission sample. Table 8, on the other hand, allows for an examination of total sample sex differences in validities and intercorrelations.

The criterion intercorrelations were quite similar for males and females as were the intercorrelations of the BI keys and the correlation between high school GPA and the ACT composite. Interestingly enough, across criteria the males were more predictable from high school rank than were the females while the reverse was true for high school GPA and the ACT composite. The usual finding in the literature has been that females are more predictable. Since the high school rank data and high school GPA data were not obtained for the same students and the percentile rank data came primarily from one institution, there may have been some institutionally specific reasons for these findings.

Validities for the two academic performance BI keys demonstrated that males and females were about equally predictable from the male GPA key, with the validities on males ranging from .32 to .49 and the validities on females ranging from .33 to .48. However, the validities for males were slightly higher (from .35 to .50) than for females (.27 to .42) using the BI composite key; the reverse of the pattern established by the ACT composite and high school GPA. It is interesting to note that the BI keys were slightly more valid for males, who have traditionally been less predictable than females with usual measures of academic achievement.

The validities for the ACT composite in predicting college GPA were .48 for males and .54 for females. This contrasted rather sharply with validities obtained in the special admission and regular admission subsamples where correlations generally in the .30's were obtained. These differences in the level of the validities in the different samples were largely a function of the unusual nature of the male and

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[4] The sample sizes for these intercorrelations involved an N of 926 for the male sample and an N of 707 for the female sample. However, for certain variables the N was restricted by missing data. Only 158 subjects had percentile rank data in the male sample and only 181 had similar data in the female sample. Other data was generally based on an N of approximately 200 or more.

TABLE 8

Intercorrelations of Selected Variables by Sex

Females Upper Right, Males Lower Left.

Variable Number and Description	1	2	3	4	5	6	7	8	9	10	11
1. High School Percentile Rank	--	00	00	32	16	33	20	36	32	51	46
2. High School GPA	00	--	60	50	58	57	49	71	50	71	68
3. ACT Composite	00	59	--	49	54	54	47	53	51	66	58
4. Class Hours Completed	54	26	34	--	47	87	49	25	28	33	27
5. College GPA	21	45	48	56	--	85	70	24	29	48	42
6. GPA-Hours Composite	62	39	45	88	88	--	69	28	33	48	39
7. Binary success	38	33	37	57	76	76	--	26	29	43	38
8. 1=Special; 2=Reg. Admission	53	70	63	24	33	32	30	--	43	33	34
9. Family Income Key	31	38	48	13	26	21	15	39	--	68	58
10. Male GPA Key	50	55	62	32	49	46	35	39	60	--	82
11. Composite Key	53	62	58	35	50	50	40	42	58	88	--

NOTE: Decimal points omitted

female samples where such a large percentage of special admission students were present. Thus, the correlations in the male and female samples between the ACT composite and college GPA were somewhat inflated due to the sample composition and did not hold at the same level when the sample was divided into regular and special admission students. The most relevant validities in terms of historical comparisons would be the validities obtained on the regular admission sample.

Analysis of Results for Low Income Students

As described in the procedure section, if the student answered alternatives A or B to question 299 of the BI which concerned their estimate of the family's total annual income, the student was classified into the low income sample. In dollar amounts this indicated that the total family income was less than $7,000.00. This classification resulted in 477 students being assigned to the low income sample. Of them, 320 had criterion data on the primary criterion of college GPA while 314 had data on hours completed. Table 9 presents the intercorrelations of selected variables for this sample. Analysis of Table 9 indicated that the high school performance measures of percentile rank and GPA had somewhat lower relationships with the college performance criteria than were obtained on the total sample (e.g., the highest r obtained was .34 between high school GPA and the GPA-hours composite). The correlations of the high school performance measures with the male GPA key, one of the most valid keys in the study, were lower than those obtained on the total sample, but were still moderately high (r's of .35 and .58 for high school rank and high school GPA respectively). The college criteria generally showed limited relationships with the control variables of black vs. white, chicano vs. white, socio-economic status, and special vs. regular admission student.

Within the low income sample the family income key generally had low relationships with the college criteria (e.g., only .19 with the college GPA measure). However, the family income key did correlate markedly with the male GPA key (.64) indicating that even among a restricted range of socio-economic status those students who had life history patterns more similar to higher income groups tended to score above average on a BI key constructed to predict college performance. The BI keys, variables 7 and 8, tended to have validities equal to or noticeably higher than those obtained by the high school performance measures, since correlations as high as .43 were obtained in predicting college GPA. These correlations on low income students further suggested the potential contribution that biographical scores could make to the admission process, as they tended to be more valid than the high school performance measures, as they were in the special admission sample.

TABLE 9

Intercorrelations of Selected Variables

Low Income Sample

Variable Description	Class Hours Completed	College GPA	GPA-Hours Composite	Male GPA Key
1. High School Rank	21	17	25	35
2. High School GPA	25	32	34	58
3. 1=black; 2=white	01	-24	-15	-05
4. Parental Education	01	00	01	09
5. 1=Special; 2=Regular	06	-01	04	09
6. Family Income Key	11	19	18	64
7. Male GPA Key	23	43	41	100
8. Composite Key	22	43	42	83

Analysis of Results for the Low Parental Education Sample

In order to further examine the validities of various predictors, a different definition of disadvantaged based upon the level of parental education was used. The low parental education sample was identified following the procedures previously described, resulting in a sample of 310 students who responded that neither parent had completed high school. Of the students in this sample, 185 had data on college GPA, 107 had high school rank data, and 51 had high school GPA data.

Intercorrelations among selected variables on this subsample are presented in Table 10. Analysis of Table 10 indicates a pattern similar to that obtained in the lower income sample, with generally lower validities for the high school performance measures than those obtained on the total sample analysis. The highest validity obtained with these measures was between high school GPA and college GPA which was only .27. Again, the control variables tended to have limited relationships with the criteria and with the BI key. Similar results were obtained for the family income key as were observed in the low income sample. The family income key had moderate correlations with the criteria but correlated substantially with the male GPA key (.63). The male GPA key and the composite key had validities which were typically slightly higher than those obtained for high school GPA. The highest validity obtained was .33 for the composite key in predicting college GPA.

Analysis of Results for the Black Sample

Intercorrelations of selected variables on black students are presented in Table 11. Of the 429 blacks who participated in this study, 249 had criterion data available on college GPA and 256 on number of hours completed. The sample size for high school rank was 235. The results revealed that high school rank did have some relationship with hours completed (.29) but had very limited validity with college GPA (.08). The composite measure, however, was slightly more predicatable as a correlation of .35 was obtained between high school rank and the number of hours-GPA composite. Again, low relationships were obtained with the control variables indicating that these measures did not have an impact on either the criteria or the keys. Particularly noteworthy were the low negative correlations obtained with the special vs. regular admission variable, indicating that blacks who were in special admission programs scored slightly higher on the criteria than blacks in regular admission programs.

The BI keys also had low validities in this sample. For college GPA, validities of only .09 and .15 were obtained for two BI keys. Low validities were also obtained for the hours completed criterion

Table 10

Intercorrelations of Selected Variables

Low Parental Education Sample

Variable Description	Class Hours Completed	Collete GPA	GPA-Hours Composite	Male GPA Key
1. High School Rank	15	12	06	45
2. High School GPA	05	27	22	43
3. Family Income	-05	-08	-08	03
4. 1=black; 2=white	07	-13	-04	-11
5. 1=Special; 2=Regular	-05	-07	-09	-03
6. Family Income Key	05	13	07	63
7. Male GPA Key	14	31	27	100
8. Composite Key	17	33	30	80

Note: Decimal points omitted

TABLE 11

Intercorrelations of Selected Variables

Black Sample

Variable Description	Class Hours Completed	College GPA	GPA-Hours Composite	Male GPA Key
1. High School Rank	29	08	35	38
2. Family Income	-07	-07	-05	01
3. Parental Education	-04	-03	-03	02
4. 1=Special; 2=Regular	-07	-12	-12	-04
5. Family Income Key	05	04	06	60
6. Male GPA Key	19	09	20	100
7. Composite Key	19	15	23	78

and the GPA-hours composite measure, as the correlations of the most effective BI key in predicting these criteria were .19 and .23 respectively. Since college GPA was not predictable by the high school performance measures or the BI keys, and in view of the fact that special admission blacks equalled or outperformed regular admission blacks, the possibility existed that the nature of the grading process was changed, perhaps as a function of black study programs.

These data do not follow the trend that has been obtained in previous studies for minority groups as reviewed in the survey of the literature. These results will be discussed further in the following chapter. It is unfortunate that additional data were not obtained on blacks from different institutions. Since only a limited amount of data was obtained, these results definitely need to be further verified in additional studies.

Analysis of Results for the White Sample

Intercorrelations of selected variables on white students are presented in Table 12. There were 956 whites available in the total sample and, of these, 912 had college GPA data and 591 had high school GPA data. In contrast to the black sample, much higher validities for the high school GPA measure were obtained as illustrated by correlations in the .40's and .50's against the college performance criteria. The correlations of the predictors and criteria with the control variables of family income, parental education, and special vs. regular admission, had a pattern similar to that obtained in the total sample. The special vs. regular admission variable had marked relationships with the college criteria, indicating that whites in regular admission programs were scoring considerably higher on the criteria than were whites in the special admission programs. This result was the reverse of that seen in the black sample. The BI keys had validities in the white sample which were very similar to those obtained in the total sample. These BI key validities were as high as, or slightly higher than, the validities for high school GPA. A typical example was the male GPA key which correlated .60 with the college GPA.

Table 12

Intercorrelations of Selected Variables

White Sample

Variable Description	Class Hours Completed	College GPA	GPA-Hours Composite	Male GPA Key
1. High School GPA	43	57	53	68
2. Family Income	07	10	09	05
3. Parental Education	07	09	09	09
4. 1=Special; 2=Regular	29	45	41	50
5. Family Income Key	23	38	34	69
6. Male GPA Key	40	60	56	100
7. Composite Key	38	58	54	87

Note: Decimal points omitted

Discussion

The purpose of this study was to investigate the validity of biographical data in the prediction of college academic performance, particularly for disadvantaged students and those who have entered through special admission programs. These students are being admitted into special programs as they may not meet regular admission standards and because of a concern that they might not be able to compete with regular admission students without remedial work. The situation is made more complex by previous research from a variety of investigators who have raised questions about the extent to which admission procedures, i.e., high school performance measures and college entrance test scores, may require different decision rules for admitting minority group members or other disadvantaged students. Since previous research had shown biographical data could be essentially independent of race in the prediction of academic performance, and since such data had also demonstrated substantial validities in predicting a wide variety of criteria, the present investigation was undertaken to more thoroughly examine the potential validity of biographical information as a predictor of college performance.

Procedural problems were encountered in the data collection phase of the study. Representative samples of special and regular admission students were not obtained from all participating institutions, nor were entrance test scores available on a sufficient number of the students. Thus, the unusual nature of the sample limited the generalizations that could be drawn from the data. The nature of the institutions and the participating subjects were not necessarily representative of what might be obtained in future studies. On the other hand, a reasonably large sample of special admission students across institutions was obtained so that a variety of implications of the data could be examined. To a lesser extent, this held for regular admission students as well. In addition, analyses of the data indicated that when special and regular admission students were considered, the sample was generally typical of other studies reported in the literature.

A finding which has been continually confirmed in numerous studies of college academic performance is that high school performance, as measured by either rank in class or GPA, is the most valid predictor of later college achievement. It is therefore particularly worthwhile to review the comparative validity of biographical data and the high school performance measures in predicting college GPA. In the special admission sample the highest validity for either high school rank or high school GPA was .18, while the male GPA key had a validity of .41, a marked difference in validity. In the low income sample the highest validity for the high school performance measures was .32 while this same BI key had a validity of .43. In the parental education sample

the highest validity for high school performance measures was .27 while this same BI key had a validity of .31. In the black sample, comparative validities for the high school performance measures and the BI key were .08 and .09, respectively. Thus, in three out of four samples which examined special admission or other definitions of disadvantaged students, biographical data were generally superior to high school performance measures in predicting GPA. On the white sample, the male sample, and the total sample, BI data were as effective, if not slightly more so, in predicting college academic performance as the high school performance measures. Only in the female sample was high school performance the more effective predictor.

These data indicate that if the concern of college admission officers is more accurate prediction of college performance so as to reduce the frustration of failure and increase the probability of admitting successful students, then biographical data should be considered as a possible supplement to current selection procedures.

As reviewed in the survey of the literature and as indicated by the results of the present study, entrance test scores are typically somewhat less valid than high school performance measures in predicting college achievement. Yet, they consistently make a significant contribution to the prediction of college performance in multiple regression equations. One of the reasons is that they provide a uniform standard for assessing academic achievement which does not vary from high school to high school as do grades. In this study and from available literature, it would appear that biographical data would generally be more valid than the entrance examinations. Biographical data also, of course, offers a uniform standard across high schools. This is not to suggest, however, that entrance test scores do not have a place in admission procedures. Besides their potential contribution to selection decisions, such information could be of benefit in counseling and placement of students.

The effectiveness of several previously existing BI keys was examined in this study, and although the empirical keys were more effective than the a priori keys, the differences were not large. There are a number of possible explanations for this phenomenon, all of which were probably partially responsible. To illustrate, the empirical keys took advantage of new items especially developed for this study while, obviously, the a priori keys did not. Since the sample involved college students rather than high school students, the a priori keys, while showing a substantial amount of validity generalization evidence, nevertheless, would not be expected to be as valid as the empirical keys. And, finally, the a priori keys may have deteriorated slightly across time, having been developed in the late sixties.

Certain keys were conspicuous because they did not produce higher validities. This was particularly true of the key constructed on the low income students to predict GPA. While focusing on a specific homogeneous sample may result in more effective keys, as in the study by Ellison et al. (1970) in predicting GPA for blacks, in other cases a larger, more representative sample which enables a throrough evaluation of item criterion relationship with unrestricted range may produce keys which are more effective. This evidently is what happened with the low income GPA keys. In the construction of empirical keys, additional research is needed on the development of homogeneous subscores based on items with significant criterion relationships. These subscores would be more reliable than individual items and appropriate for weighting in multiple regression equations.

In the present study the correlations between race variable and the BI keys designed to predict academic performance were generally zero. This provides further confirmation of implications from studies reviewed in the literature that separate decision rules for various racial groups may not be necessary for BI data. However, in this study, and also in earlier studies of BI data, the criterion measures have also correlated with race at an essentially zero level. The question may legitimately be asked: Would the nondiscriminating nature of BI data between whites and blacks detract from validity and be biased against whites, if in fact, whites did perform more effectively on the criterion measures as some authors conclude is the case? (Humphreys, 1969, Stanley, 1969). The results from this study, as well as those from earlier studies, indicated that empirically constructed BI keys tend to parallel the criterion measures in their relationships with other variables and thus, in such situations, the relationship between the predictor and race would be expected to parallel that of the criterion and race. This can be illustrated by a study of integrated high schools in North Carolina where the correlation between a binary race variable (black vs. white) and high school GPA was .26 indicating that whites obtained higher GPA's than blacks (Ellison, James, Fox, and Taylor, 1970). The BI keys empirically generated in that study paralleled the criterion measure in terms of its correlations with race and a correlation of .23 between race and the empirical BI key was obtained. The data in this earlier study were further analyzed in light of current approaches to empirically assess racial fairness and it was found that by most definitions the BI keys were not biased against blacks (Murray, Ellison, and Fox, 1973). This resulted despite the fact that it was possible to build BI keys from the same instrument which would differentiate between blacks and whites (Fox, 1972).

In the present study further support was given to this phenomenon with respect to the special vs. regular admission variable. This program classification variable correlated .30 with college GPA and .37

with the BI key generated to predict college GPA. In addition, near zero correlations between family income and the criteria were matched by near zero correlations between family income and the BI keys developed to predict academic performance criteria, and the same result was obtained using level of parental education as the cultural variable. In short, the BI keys were related to membership in various cultural groups at about the same level as were the criterion measures.

This evidence parallels that reported by Fox (1972), indicating that the problem of differential decision rules for racial or cultural groups with biographical data is not likely to be a problem, rather it is a function of the criterion-race relationship, and, therefore it is likely that biographical data would not require differential decision rules for different minority groups.

The nature of the problem may also be illustrated using a different approach. Taking the correlations between race and BI scores at face value, these relationships indicate that self-descriptions, academic experiences, values, aspirations, study habits, achievement orientation, etc., which are associated with academic performance did not differ in sum across blacks and whites. Since blacks and whites in this study did differ in their high school performances, but performed equally well in college and on the BI keys (as shown in Table 6), these relationships suggest that either special admission programs are contributing to greater equality or the criterion has changed in terms of its composition, measurement, or reliability. Once again, the important characteristic in evaluating the non-discriminatory possibilities of BI data turns upon the criterion problem and not on BI data. That is, the empirically generated BI keys will tend to parallel the criteria, regardless of the relationship between the criteria and race.

In contrast to BI data which tends to parallel the criteria-race relationships, standardized achievement test data yield results such that many blacks and other disadvantaged groups tend to score low, approximately one standard deviation below the mean. As a way out of this dilemma, Darlington, in two separate papers (1971, 1973) has advocated that criterion scores be adjusted within cultural or racial minorities. The proposed adjustment was essentially to add a constant to the criterion scores for the minority group in question. This constant would be based upon a subjective administrative decision concerning the priority placed upon admitting minorities to institutions of higher education. Darlington did not deal with the number of uses to which the new criterion variable would be put, although there would seem to be a considerable difference between using the adjusted criterion for purposes of selection, which is primarily related to test development, and for purposes of the assessment of merit, which

is associated with the criterion problem. Linn (1973) stated that it was extremely unlikely that any institution would seriously consider formally adopting the proposal to adjust criterion scores to give minority group members a break. However, he also felt that some institutions were already doing this on an implicit basis. The results of the present study would seem to support this contention to some extent. Blacks in special admission programs did score slightly higher on the college criteria than blacks in regular admission programs, while just the opposite was true for whites.

Given the almost nonexistent validity for college GPA in predicing career performance (Hoyt, 1966), it is possible that the adjusted criterion score is "much ado about nothing." At any rate, it would seem that Darlington is on target by focusing upon the criterion problem, while the treatment offered would not seem to speak to the more important facets of the criterion problem as it applies to the assessment of merit. It is argued here that the use of criteria for predictor development and selection is not equivalent to the use of criteria for the assessment of merit. The problems which result from confusing the two uses of criteria are many.

Despite the findings of very low relationships between BI data and college academic performance for blacks in the present study, there is enough evidence available to indicate that this finding is probably atypical and should not hinder further research efforts. In the previous study by Ellison et al. (1970) substantial relationships were obtained on black students (e.g., correlations of .65 were obtained in predicting high school academic performance). In the study by Abe (1970) substantial validities for biographical data (e.g., .62 vs. a .60 multiple R for ACT and high school performance scores) were reported when scoring procedures developed on southern blacks and whites were applied to chicano students at a southwestern unviersity. Further, the study by Tseng (1973) indicated substantial validity for biographical data on an entirely different cultural group, that is, Chinese college students. In view of these results and the slightly negative relationship between special vs. regular admission programs and college GPA in the black sample, it is possible that the lack of validity in the BI data in this study was a function of the nature of the special admission programs for black students. Restated, the criterion again becomes a crucial issue and further research is warranted.

Throughout this discussion and in the literature in general, much has been said about the key role of the criterion in any selection model. In particular, Linn (1973) has discussed the basic assumption of fairness in the criterion and the importance of meeting this assumption in order to deal with fairness in a predictor. In the present study and in most treatments of racial or cultural fairness in measurement, the emphasis has been on a single criterion model as

opposed to a multiple criterion model. Somewhat of a hybrid model would be one which stresses composite criteria. Each of these models results in different perspectives and treatments of research and various issues of validity and fairness. Within the context of college admission the criterion has usually been a composite of virtually unknown heterogeneity, namely GPA. The possibility of adopting a multiple criterion model as a component of a more comprehensive selection model such as Dunnette's (1963) moderator model mentioned below makes the fairness issue even more complex. The important issue would then become one of determining bias with reference to each criterion, and an overall statement of validity or bias would not necessarily be appropriate. This point has a parallel on the predictor side as well. That is, even with the models of racial or cultural fairness which exist, nothing adequately covers what should be done when there are multiple groups for whom fairness must be demonstrated simultaneously. Biographical information, because of its heterogeneity and the demonstrated manner in which empirically generated BI keys parallel criteria in terms of their intercorrelations with other variables, may be particularly effective for a selection model employing multiple criteria.

While the present investigation was not conducted within the framework of a specific selection model, it is important to note the relationships of the findings in this study to the moderator model presented by Dunnette (1963). The moderator model of selection suggests that different subgroups may require different predictors because of unequal validities with standard predictors. The problem would be to find predictors for those "unpredictable" subgroups. In this study, biographical information was more valid than traditional predictors when various subgroups were examined. Validities of high school performance in predicting college performance were particularly low for special admission students (e.g., the highest validity was .18). However, the validities of the BI keys for predicting college performance on this subsample of special admission students were approximately .40.

Females have historically been more predictable than males. While this was true with respect to the ACT composite and high school performance in the present study, it was not true for the male GPA key and the composite key. The maximum validity for a BI key on the male sample was .50 while on females the maximum validity was .48. Another example was the validities for the BI keys which were higher than the validities for high school performance measures within the low income sample and the low parental education sample.

It would seem, therefore, that greater predictive effectiveness might be obtained through biographical information in conjunction with a model such as Dunnette's, specifically adapted to meet the requirements of college admissions. In addition to considering various

combinations of predictors for different subgroups, such models should consider the use of all predictors for counseling and placement purposes, i.e., toward institutions and majors compatible with individual characteristics, developmental sequences or regular admission programs, etc. Further research which would more directly speak to these possibilities is warranted.

As briefly mentioned in the introduction, college grades may themselves be a tentative, intermediate, and unsatisfactory criterion. In terms of the evolution of social institutions, the college educational process could evolve to such a point that different kinds of performances required and the grading system reflecting these performances, would bear some closer relationship to career performance which is one of many criteria for judging the educational process. To the extent that this occurs, selection procedures should evolve along with educational strategies and come to reflect not only performance in institutions of higher education but also, hopefully, to guide the selection process toward more efficient utilization of our nation's human resources.

Summary and Conclusions

The purpose of this study was to investigate the validity of biographical data in the prediction of college academic performance, particularly for disadvantaged students and those who entered college through special admission programs. The sample was made up of 1640 students drawn from six major universities, three eastern (one of which was predominantly black), two midwestern, and one western. There were 982 special admission students, 554 regular admission students, and 104 students from the black university. The data analyzed in the study included high school performance measures, college GPA, number of hours completed in college, composites of these college performance measures, college entrance test scores which were limited to one university, and ALPHA II, a specially developed biographical inventory form. This form contained 300 items covering a variety of content areas including attitudes, interests, achievements, study habits, home and family characteristics, self-descriptions, etc. The form was largely based on previous research studies with biographical data which had shown substantial validities in predicting academic performance.

The data analysis consisted of scoring the biographical data with a variety of keys from previous research studies and the development of empirical keys for the college criteria in a double cross validation design. In addition to the total sample analysis, a number of subsamples were analyzed. These subsamples included students classified in terms of special admission, regular admission, males, females, low-income, students whose parents had limited education, blacks, and whites.

The results indicated the biographical data were generally equally effective or slightly superior to the high school performance measures in predicting college GPA. In three out of four samples which included special admission or other definitions of disadvantaged students, biographical data were generally superior to the high school performance measures. For example, in the special admission sample, the highest validity for either high school rank or GPA in predicting college GPA was .18 while the most effective BI key had a validity of .41. On the white sample, the male sample, and the total sample, BI data were as effective if not slightly more effective in predicting academic performance than were the high school performance measures. Only in the female sample were the high school performance measures more effective. The entrance test scores, as reviewed in the literature survey and in the results of the present study, were generally less effective than the BI scores.

The findings of the study also confirmed previous research

which indicated that biographical scoring keys did not provide any differentiation between blacks and whites, as correlations of approximately zero were obtained between the empirical BI keys and this race variable. It was observed that the degree of relationship between biographical data and race was largely a function of the criterion-race relationships. If criterion differences existed in the performance of various racial groups, then biographical data, when empirically keyed, tended to produce relationships with race or minority group classifications which parallel the criterion-race relationships. This is in marked contrast to entrance test scores where significant differences have been reported between racial groups. In this study, high school rank also showed similar characteristics.

In view of the validities obtained for biographical data in predicting college performance, particularly among various disadvantaged groups, and the lack of differentiation between blacks and whites as well as its demonstrated effectiveness in paralleling criterion measures, it is recommended that such information be examined as a supplement to current college admission procedures including placement and counseling. The discussion of the findings within the context of various other selection considerations including moderator models, also indicated that further research was warranted.

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